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Serum cholinesterase as biomarker in liver disorders

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Abstract

Liver disorders are the major leading cause of morbidity and mortality worldwide. Biochemical tests for the assessment of liver function include measurement of serum total bilirubin (TB), serum aspartate and alanine transaminases (SGOT & SGPT), serum alkaline phosphatase (ALP), serum protein and albumin. However these tests are often abnormal in patients with clinical problems other than liver dysfunction. Serum cholinesterase or Pseudocholinesterase (PChE) is synthesized in liver and secreted into plasma. Hepatocellular impairment will reflect a decreased enzyme activity. The study group consisted of 120 subjects, of age groups 20-60 years and of both sexes. Of these, 40 were viral hepatitis cases (Group 2), 40 were cirrhosis of liver cases (Group 3) and 40 were healthy individuals as controls (Group 1). Serum PChE, TB, SGOT, SGPT, ALP were estimated in all the individuals. Results showed that the serum levels of PChE are decreased in both Group 2 & Group 3 patients (Group 3 > Group 2) when compared to Group 1. Other Lft's showed increase in both groups when compared to controls. The decrease in PChE is extremely statistically significant in both groups when compared to controls ($p < 0.0001$). Hence PChE can be used as a routine diagnostic test besides other liver function tests for investigation of liver disorders.

Keywords: Pseudocholinesterase, SGOT, SGPT, ALP. Viral hepatitis, Liver cirrhosis

Introduction

Liver disorders are the major leading cause of morbidity and mortality worldwide [1]. Biochemical tests for the assessment of liver function (commonly referred to as liver function tests) includes measurement of, serum bilirubin, serum aspartate and alanine transaminases serum alkaline phosphatase, serum protein and albumin. However these tests are often abnormal in patients with clinical problems other than liver dysfunction [2].

The activities of serum transaminases may be raised due to increased release from non-liver tissue sources in various pathologies. Increased serum alkaline phosphatase activity may result from physiological or pathological enzyme production and release from non-liver tissue sources. Serum bilirubin may be raised because of increased erythrocyte breakdown rather than because of failure of hepatic clearance [3].

Pseudocholinesterase (PChE) is also known as Butyrylcholinesterase (BChE), serum cholinesterase, false cholinesterase or most formally acyl choline acyl hydrolase. It is found in central and peripheral nervous system, kidney, intestine, pancreas and liver (hepatocytes) [4-6]. It is synthesized in liver and secreted into plasma mainly as a tetrameric glycoprotein [7, 8]. It can hydrolyse hydrophobic and hydrophilic carboxylic or phosphoric acid ester containing compounds [9]. It was so named due to its ability to hydrolyse butyrylcholine faster than other esters [10]. The half-life is about 12days [11-14]. Its normal value ranges between 4620 and 11,500 IU/L [15, 16].

The level of PChE measurement serve as a sensitive indicator of synthetic capacity of liver, any decrease in PChE activity reflects impaired synthesis of enzyme by the liver [17]. Hepatocellular impairment will reflect a decreased enzyme activity. In fact, plasma level falls in acute and chronic liver damage, cirrhosis, and liver metastases, being a biochemical marker of organ damage [14]. Physiologically, the function of this enzyme is not known [18, 19]. A very severe fulminant liver disease can end in death before the enzyme level shows a significant fall [4].

Keeping this in view, the objective of the present study is to estimate the serum levels of Cholinesterase and other liver function tests in patients with viral hepatitis and liver cirrhosis and compare them with healthy controls.

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2. Materials & Methods

2.1. Study centre & Period: This research was conducted at Rangaraya Medical College between November 2015 and June 2016.

2.2. Subjects Selection: Patient selection was done by simple random sampling of individuals among the age group 20-60 years of both sexes, presenting to the O.P Department, Government General Hospital, Kakinada. An informed consent was taken from the patients and controls before the collection of blood sample. The subjects were selected based on following inclusion and exclusion criteria.

2.3. Inclusion Criteria

- 40 diagnosed cases each of cirrhosis of liver and viral hepatitis.
- Controls were healthy individuals, age and sex matched without any major illness.

2.4. Exclusion Criteria

- Congenital liver disorders.
- Chronic malnutrition.
- Organophosphorus poisoning cases.
- Muscular dystrophy.
- Pregnancy.

2.5. Study Pattern

- **GROUP 1: CONTROLS** - 40 age and sex matched healthy individuals.
- **GROUP 2: CASES** – 40 patients with Viral Hepatitis and
- **GROUP 3: CASES** - 40 patients with Cirrhosis of liver.

2.6. Assay of Markers: Cholinesterase in Serum was measured by New DGKC

Method, serum Bilirubin by Diazo method, serum SGOT, SGPT and ALP by IFCC Kinetic method on Erba Chem 5 Semi auto analyzer. The biochemical assay was carried within 24hrs.

2.7. Statistical Analysis: All results were expressed as Mean \pm S.D. The data obtained were analyzed using Student's t-test for p-value, where $p < 0.001$ was considered as highly significant.

3. Results & Observations

The results obtained for various parameters are tabulated as follows –

Table 3.1.

Value	Group 1 (N=40)	Group 2 (N=40)	Group 3 (N=40)
Cholinesterase (IU/L)	7129.96 \pm 1912.23	2667.53 \pm 678.18	1942.50 \pm 480.29
Total Bilirubin (mg/dl)	0.69 \pm 0.24	6.22 \pm 4.64	3.89 \pm 2.14
SGOT (IU/L)	22.53 \pm 0.98	184.74 \pm 9.24	69.25 \pm 3.54
SGPT (IU/L)	26.26 \pm 1.83	208.62 \pm 12.74	78.46 \pm 5.45
ALP (IU/L)	64.0 \pm 1.62	169.37 \pm 8.28	119.84 \pm 6.82

The values of Serum Cholinesterase are decreased in Group 2 and Group 3 (cases: Group 3 > Group 2), when compared to Group 1 (controls). On the other hand, the values of Total

Bilirubin, SGOT, SGPT, and ALP are increased in Group 2 and Group 3 (cases) when compared to Group 1 (controls).

Table 3.2.

	p value (Gr.2/ Gr.1)	p value (Gr.3/ Gr.1)	p value (Gr.3/ Gr.2)
Cholinesterase (IU/L)	<0.0001*	<0.0001*	<0.0001*
Total Bilirubin (mg/dl)	<0.0001*	<0.0001*	0.0051**
SGOT (IU/L)	<0.0001*	<0.0001*	<0.0001*
SGPT (IU/L)	<0.0001*	<0.0001*	<0.0001*
ALP (IU/L)	<0.0001*	<0.0001*	<0.0001*

*extremely statistically significant, ** highly statistically significant.

4. Discussion

Several qualitative inferences can be drawn on the basis of the results in our present study. As liver synthesizes pseudocholinesterase, its levels reduce when the functional parenchymal cells are damaged or decreased. A decreased serum pseudocholinesterase activity reflects Hepatocellular impairment^[20].

In cirrhosis of liver pseudocholinesterase level would decrease very much when the number of functional parenchymal cells of liver decreases. However, in infective hepatitis the liver cells are damaged but hepatocytes are not decreased as compared to cirrhosis of liver^[21]. This explains the difference in serum levels in both the liver disorders. The findings of present study correlate well with findings of previous studies of P Dhungana A *et al.* (2014), Ruchi Gokani *et al.* (2014), Vihan C *et al.* (2014), S Venkata Rao *et al.* (2011) etc.

Data from study conducted by Khan^[22] pointed that 100% patients with cirrhosis had lower serum cholinesterase level and he also showed that there was close relationship between the severity of cirrhosis and level of serum cholinesterase enzyme. Our study is also in accordance with the study of Ogunkeye^[23], which reported lower level of serum cholinesterase level in liver disease patients. William Burnett also found serum cholinesterase is useful both as a liver function test and in the diagnosis of jaundice^[24]. Ramachandran *et al* found Median serum ChE in cirrhotics was 1590 IU/L (110-8143) compared to controls 7886IU/L (2022- 21673), $p < 0.001$. Serum ChE levels below 3506 had a 98.7% sensitivity and 80.3% specificity in predicting cirrhosis found serum ChE is an excellent biomarker of cirrhosis with good sensitivity and specificity^[25].

5. Conclusion

The results of the present research provide valuable

Information and association between serum cholinesterase and liver disorders – Viral hepatitis and Cirrhosis of liver. The findings showed that there was significant decrease in the levels of pseudocholinesterase. Hence we suggest that serum cholinesterase can be used as a routine diagnostic test besides other liver function tests for investigation of liver disorders.

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